

REPORT OF THE INTERMINISTRY TASK FORCE ON
BIOMEDICAL WASTE

A STRATEGY FOR THE MANAGEMENT
OF BIOMEDICAL WASTE

1986

TASK FORCE ON BIOMEDICAL WASTE

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TABLE OF CONTENTS

	Page No.
1.0 SUMMARY AND RECOMMENDATIONS	1
1.1 Recommendations	1
2.0 INTRODUCTION	6
3.0 ROLE STATEMENTS	7
3.1 Role of the Ministry of the Environment	7
3.2 Role of the Ministry of Health	8
3.3 Role of the Ministry of Labour	8
3.4 Role of the Municipality	9
3.5 Role of the Medical Officer of Health	9
3.6 Role of the Private Medical Laboratory	10
3.7 Role of the Health Care Facility	10
3.8 Role of the Biomedical Waste Carrier	11
4.0 MANAGEMENT OF BIOMEDICAL WASTE	13
4.1 The Disposal of Biomedical Waste	13
4.2 Complaints of Incinerator Odour & Smoke	14
4.3 Survey of Hospital Incinerators	14
4.3.1 Hospital Incinerator Inventory	14
4.4 Current Cost of Waste Disposal for Hospitals	16
4.5 Current Cost of Waste Disposal for Private Laboratories	17
4.6 Impact of Amendments to Regulation 309	17
4.6.1 Legal Definition of Biomedical Waste	17
4.6.2 Manifesting of Biomedical Waste for Transportation	18
4.6.3 Impact on Health Care Industry	19
4.6.4 Impact on Licensed Waste Carrier	19
4.6.5 Impact on the Use of Existing Hospital Incinerators	20
4.6.6 Annual Report on Condition of Existing Hospital Incinerators	20
4.6.6.1 Annual Submission by Hospital on Operation of Existing Incinerator	21
4.7 Sharing of Waste Decontamination Equipment in Hospitals	22
4.7.1 Hospitals Sharing the Use of Existing Incinerators	22
4.7.2 Existing Incinerators Shared by Other Hospitals and Laboratories	22
4.7.3 Sharing Existing Steam Autoclave to Decontaminate Waste	23
4.8 Centralized Waste Processing Facilities	23
4.8.1 Proposed Metro-Toronto Central Incinerator	24
4.8.2 Central Incinerator in Other Major Centres	24

TABLE OF CONTENTS (Continued)

	Page No.
4.9 Engineering Planning and Design Considerations	25
4.9.1 Predicting Quantity of Biomedical Waste Generated in a Hospital	26
4.9.2 Sizing of Decontamination Equipment	26
4.9.3 Alternate Decontamination Technology	27
4.10 Guidelines on Handling of Biomedical Waste	27
4.11 Manuals of Procedure for Waste Handling	29
4.12 Licensing and Routine Inspection of Laboratories	29
4.13 Training and Education	29
4.14 Research Needs	30
4.14.1 Steam Autoclave	30
4.14.2 Incinerator	30
4.14.3 Hammermill	31
4.14.4 Radiation for Sterilization of Waste	31
4.14.5 Research into Standards on Incineration Emissions and Ash	31
5.0 CONTINGENCY PLAN FOR THE EMERGENCY MANAGEMENT OF BIOMEDICAL WASTE	33
5.1 Introduction	33
5.2 Major Emergency	33
5.3 Disposal Options During Emergency	34
5.4 Lead Official/Agency	35
6.0 STRATEGY FOR THE MANAGEMENT OF BIOMEDICAL WASTE	36
6.1 Strategic Considerations	36
6.2 Status of Hospital Incinerators	37
6.3 Guidelines and Regulations	37
6.3.1 Guidelines for the Handling and Disposal of Biomedical Waste	37
6.3.2 Regulation 309	38
6.3.3 Regulation 308	38
6.4 Destruction/Decontamination Methods	38
6.4.1 On-Site Incineration versus Off-Site Treatment	38
6.4.2 Incinerator versus Autoclave	39
6.4.3 Commercial Disposal Service versus On-Site Facilities	40
6.5 Recommendations for the Strategic Management of Biomedical Waste in Ontario	41

APPENDICES

INDEX OF APPENDICES

APPENDIX I	NOTICE TO ALL METRO-TORONTO HOSPITALS
APPENDIX II	INSTRUCTION ON FORM OF ANNUAL SUBMISSION

LIST OF TABLES

		<u>Page No.</u>
TABLE 1	HOSPITAL INCINERATOR INVENTORY, BY AGE	15
TABLE 2	PROBABLE REMEDIAL ACTION REQUIRED	15
TABLE 3	TENTATIVE GROUPING OF POPULATION CENTRES FOR REGIONAL FACILITIES	25
TABLE 4	PREDICTING INCINERATOR CAPACITY	26

1.0 EXECUTIVE SUMMARY AND RECOMMENDATIONS FOR THE STRATEGIC MANAGEMENT OF BIOMEDICAL WASTE IN ONTARIO

The strategy recommendations in this report have a number of components. These components include short-term solutions such as incinerator upgrading or replacement in selected hospitals, a longterm policy for the establishment of central facilities, publication of new regulations and guidelines which affect waste handling, the use of alternative or new technologies and other options for waste disposal, cost-benefit considerations, and research suggestions. Recommendations 2 through 4 address the immediate needs of Ontario hospitals that depend on their deficient on-site waste incinerators to dispose of their biomedical waste.

Recommendations 1 and 5 through 8 address the longer term strategy for construction of regionally centralized waste disposal facilities.

The reliance by hospitals and most medical laboratories for disposal of biomedical waste outside Ontario, combined with the many hospital incinerators requiring upgrading or replacement, leads to the conclusion that a major enhancement of the biomedical waste treatment capacity is essential in Ontario. This increased capacity will lessen the risk to the public health and will materially assist in coping with any foreseeable contingency.

1.1 RECOMMENDATIONS

1. It is wise and opportune to resolve the recurring problem of biomedical waste disposal for the future by centralizing these waste disposal services in Ontario where feasible. This strategy will permit all biomedical waste generators, the hospitals, medical laboratories and commercial operators, to have access to a central user pay disposal facility offering the following advantages:
 - economy of scale through modular design of the centralized facility;
 - environmental control through improved control of emissions and use of expert incinerator operators and qualified maintenance staff;
 - state-of-the-art equipment resulting in lower emission dispersion levels when compared to many smaller incinerator operations being replaced;

- continuous service ensured through provision of standby plant;
- energy from waste as a potential option;
- only licensed waste carriers using appropriate equipment will have access to the disposal facility.

Accordingly, it is recommended that:

AS A MATTER OF POLICY, THE GOVERNMENT SHOULD PROMOTE THE ESTABLISHMENT OF REGIONALLY CENTRALIZED BIOMEDICAL WASTE DISPOSAL FACILITIES.

In this regard, the potential for using the facilities planned by the Ontario Waste Management Corporation should be explored.

Implementation of this policy option will be influenced considerably by cost/benefit analyses within a region where a number of hospital incinerators require to be upgraded simultaneously. Recommendation 5 addresses the process for selecting the optimum regional configuration.

2. The short-term site-specific needs of hospitals must be recognized and satisfied in the interim as the complementary policy on regional centralization is implemented. It is recommended that:

SHORT-TERM, LOW COST ACTIONS BY HOSPITALS TO UPGRADE DEFICIENT INCINERATORS SHOULD BE RAPIDLY IMPLEMENTED WHEREVER FEASIBLE.

3. A combination of the components of the strategy will lead to the optimum solution for the handling and disposal of biomedical wastes in Ontario, both in site-specific applications and in a broad province-wide sense. To achieve this optimum solution for each area of the province, there is an immediate need to ascertain those hospital incinerators which clearly do not meet provincial regulatory requirements. It is recommended that:

DETAILED COMBUSTION ENGINEERING ANALYSES BE CARRIED OUT ON THOSE HOSPITAL INCINERATORS IDENTIFIED TO BE DEFICIENT.

4. The financial implications of having an incinerator evaluation carried out and having treatment and disposal facilities upgraded is the responsibility of the individual hospital but with assistance provided by the Ministry of Health. Given the apparent backlog of required work (Regulation 309. S.26), it is recommended that:

THE MINISTRY OF HEALTH SET ASIDE A SPECIAL BUDGET TO ASSIST HOSPITALS IN THE UPGRADING OF EXISTING INCINERATORS.

5. The combustion engineering analyses referred to above will clarify what remedial action is needed to meet regulatory requirements and its probable cost. Low cost, remedial action where indicated should be proceeded with as soon as possible. Where replacement of the hospital incinerator is indicated or where the cost of in-situ remedial action is substantial (e.g. exceeds \$100,000), it is recommended that:

BEFORE ANY FUNDS ARE COMMITTED, A COST BENEFIT ANALYSES BE CARRIED OUT OF THE VARIOUS OPTIONS AVAILABLE AND DESCRIBED IN THIS REPORT SUCH AS:

- ON-SITE TREATMENT INCLUDING CONSIDERATION OF NEW TECHNOLOGY OR USE OF PRIVATE CARRIERS;
- CENTRALIZED OR REGIONAL FACILITIES OPERATED BY A HOSPITAL, MUNICIPALITY, PRIVATE SECTOR OR A PROVINCIAL AGENCY.

6. The government should adopt a pro-active stance to encourage hospitals, which are largely autonomous, to move towards centralization of disposal facilities or the sharing of existing facilities. Hospitals should assess their options for waste disposal and consult with the Ministry of Health. It is recommended that:

THE MINISTRY OF HEALTH BE CONSULTED UNDER THE PUBLIC HOSPITALS ACT FOR ASSISTANCE IN FUNDING WITH RESPECT TO LONG TERM IMPLEMENTATION OF THE PROVINCIAL STRATEGY FOR THE MANAGEMENT OF BIOMEDICAL WASTE.

7. In any planning of centralized biomedical waste disposal facilities the needs of health care facilities and the private medical laboratories located in the area under consideration should be considered. It is recommended that:

MEDICAL LABORATORY BIOMEDICAL WASTE DISPOSAL NEEDS SHOULD BE INCLUDED IN THE PLANNING OF CENTRALIZED BIOMEDICAL WASTE DISPOSAL FACILITIES.

8. In order to assist hospital administrations and the Ministry of Health in selecting and financing incineration or other treatment or disposal alternatives, particularly where centralized facilities are being considered, and in a general sense assist in the implementation of the strategy including initiating area studies, it is recommended that:

A WORKING GROUP OF PROFESSIONALS HAVING REPRESENTATION, AS A MINIMUM, FROM THE MINISTRIES OF HEALTH AND ENVIRONMENT BE APPOINTED AND FUNDED TO ADVISE ON PRIORITIES AND ASSIST IN THE IMPLEMENTATION OF THE STRATEGY FOR THE MANAGEMENT OF BIOMEDICAL WASTE.

This working group will be assisted by broader based regional working groups representing all the organizations having an interest in establishing a regional centralized facility.

9. The provisions of Regulation 309 and other sections of the Environmental Protection Act place stringent controls over the movement and disposal of this hazardous waste. It is recommended that:

ALL GENERATORS OF BIOMEDICAL WASTE REVIEW THE LEGISLATION TO ENSURE THAT THEY MEET THE REQUIREMENTS OF REGULATION 309 INCLUDING REGISTRATION AND MANIFESTING OF THE WASTE, AND THE USE OF APPROVED CARRIERS AND DISPOSAL FACILITIES.

10. The traditional disposal techniques for biomedical waste have been incineration and steam sterilization. However, questions have been raised about the adequacy of the air emission criteria for incinerators burning infectious waste. Also, new innovative treatment technology has been developed in the United States which requires demonstration and testing in Ontario. It is recommended that:

RESEARCH INITIATIVES SUCH AS THE TESTING OF ALTERNATIVE TECHNOLOGY AND CRITERIA DEVELOPMENT BE SUPPORTED BY THE MINISTRIES OF HEALTH AND ENVIRONMENT.

11. The policy and guidelines for the disposal and handling of biomedical waste have been revised by the Ministry of the Environment. These guidelines, which contain an updated definition of biomedical waste, have received extensive interministry review. Regulation 309 currently contains an outdated definition of this hazardous waste. Also, the question of including some aspects of the waste handling guidelines into the regulation has been raised. It is recommended that:

THE MINISTRY OF THE ENVIRONMENT REVIEW REGULATION 309 FOR THE PURPOSE OF UPDATING ITS DEFINITION OF "PATHOLOGICAL WASTE" AND CONSIDER THE INCLUSION OF SPECIFIC BIOMEDICAL WASTE HANDLING PROCEDURES INTO THE REGULATION.

12. Waste disposal in an emergency can lead to very undesirable conditions and, in fact, such conditions led to the formation of the Task Force on Biomedical Waste. Every generator and receiver of biomedical waste should have a clear understanding of the contingency procedures required to ensure safe handling and disposal of the waste during emergencies. It is recommended that:

EVERY BIOMEDICAL WASTE GENERATOR AND RECEIVER PREPARE AND HAVE AVAILABLE A CONTINGENCY PLAN FOR THE DISPOSAL OF BIOMEDICAL WASTE IN EMERGENCY SITUATIONS WHEN ROUTINE DISPOSAL ARRANGEMENTS ARE INTERRUPTED. THIS CONTINGENCY PLAN SHOULD BE FILED WITH THE MEDICAL OFFICER OF HEALTH.

2.0 INTRODUCTION

The Ontario Minister of the Environment in mid 1983 announced that the Ministry would undertake a major review of waste management practices across the Province. As part of the "Blueprint for Waste Management" review the Ministry also decided to carry out an inventory and assessment of pathological waste incinerators and revise the existing guidelines on the handling and disposal of pathological waste. The need for the inventory of pathological waste incinerators was further focused when a public health emergency occurred early in 1984 in the Town of Markham, Ontario.

An interministry Task Force was formed in April 1984 to deal with the short term problems arising from the Markham incident and the subsequent critical accumulation of waste stored in private diagnostic laboratories across the Province as a result of the licensed waste haulers serving this industry being denied routine access to hospital incinerators.

This study discusses the work completed by the Task Force under the task force terms of reference including recent surveys of Ontario hospitals and their waste handling practises and the operating condition of biomedical waste incinerators used in these hospitals.

This study provides a comprehensive strategy for the management of biomedical waste in Ontario.

3.0 ROLE STATEMENTS

The task force on biomedical waste in its terms of reference had the task of defining the roles of the various agencies and parties involved in aspects of biomedical waste handling and disposal. It was also recognized that a successful strategy for biomedical waste handling and disposal depended on the various agencies and parties understanding and accepting their assigned roles. Extensive discussions with the organizations concerned have resulted in the following general statements.

3.1 ROLE OF MINISTRY OF THE ENVIRONMENT WITH RESPECT TO BIOMEDICAL WASTE ISSUES

1. To implement and enforce provisions of the Environmental Protection Act and Regulations for the control, handling, manifesting, transportation, treatment, and safe disposal of biomedical waste including pathological waste and infectious waste as well as the licensing of the related transport vehicles, treatment facilities, and landfills.
2. To provide the policy, provincial strategy and guidelines for the control, handling, transportation, decontamination, and safe disposal of biomedical waste.
3. To provide, for approval purposes, guidelines on design and operational criteria for devices and equipment used in the transportation, incineration, decontamination, and disposal of biomedical waste.
4. To issue a Certificate of Approval with appropriate conditions to any qualified proponent, owner, or operator of a biomedical waste management system, vehicle, incinerator or other disposal device involving the use of the Ontario manifest form to store, handle, transport, decontaminate or dispose biomedical waste.
5. To investigate, on the report of a provincial officer, Medical Officer of Health, Physician, or any other qualified person; the improper handling, packaging, storage, transportation, decontamination and disposal of biomedical waste.

3.2 ROLE OF THE MINISTRY OF HEALTH WITH RESPECT TO BIOMEDICAL WASTE ISSUES

1. To provide a consultation service with respect to communicable disease concerns related to biomedical waste handling and disposal.
2. To communicate with health units, other ministries and agencies, and professional organizations, on health issues related to the handling and disposal of biomedical wastes.
3. To respond, as required, to requests from health care facilities for planning support engineering consultation and review, and funding assistance for remedies to biomedical waste handling problems.
4. To support the implementation of guidelines developed by other Ministries (MOE and MOL) for the handling and disposal of biomedical wastes.
5. To administer the Health Protection and Promotion Act and Regulations in relation to the handling and disposal of biomedical wastes.

3.3 ROLE OF MINISTRY OF LABOUR WITH RESPECT TO BIOMEDICAL WASTE ISSUES AND OCCUPATIONAL HEALTH AND SAFETY

1. To administer the Occupational Health and Safety Act and Regulations in relation to workers operating, maintaining or repairing biomedical waste management facilities.
2. To review existing programs and develop new strategies, regulations, guidelines, codes and hazard alerts to prevent occupation-related injuries and illnesses among workers, including the above class.
3. To advise, educate or train (as appropriate) all parties with respect to rights, duties and responsibilities under the legislation.
4. To provide advice and assistance (as appropriate) to the Medical Officer of Health in the administration of the Health Promotion and Protection Act and to the Ministry of the Environment in the administration of the Environmental Protection Act.

3.4 ROLE OF MUNICIPALITIES WITH RESPECT TO
BIOMEDICAL WASTE ISSUES

1. To the extent that the collection, transportation and disposal of pathological wastes is a provincial responsibility, municipalities will support the Government of Ontario with its task by including, where deemed necessary by the municipality, reference to the provincial biomedical waste collection and disposal system in municipal waste collection by-laws.
2. Municipalities will co-operate with the Ontario government approval function by restricting pathological and infectious waste from municipal landfill sites.
3. Municipalities will liaise and co-operate with the Ministries of Health, Labour, Environment, local Boards of Health, Associations and other public organizations as necessary on biomedical waste handling issues.
4. Municipalities will co-operate with the appropriate ministries of the provincial government in contingency planning for situations involving biomedical waste "spills".

3.5 ROLL OF THE MEDICAL OFFICER OF HEALTH WITH
RESPECT TO BIOMEDICAL WASTE ISSUES

1. To administer the Health Protection and Promotion Act and Regulations in relation to the handling and disposal of biomedical waste.
2. To provide a consultation service with respect to communicable disease concerns related to personnel handling and disposing biomedical waste in health care facilities, laboratories and industrial and municipal environments.
3. To co-operate with provincial agencies and municipal authorities in situations relating to the handling and disposal of biomedical waste and public health.
4. To promote the implementation of guidelines published by provincial agencies and other professional bodies relating to the safe handling and disposal of biomedical waste.

3.6 ROLE OF PRIVATE MEDICAL LABORATORIES WITH
RESPECT TO BIOMEDICAL WASTE ISSUES

1. To implement waste handling guidelines developed by the Ontario Association of Medical Laboratories and provincial agencies for use in private laboratories.
2. To comply with the requirements of the Environmental Protection Act and Regulations and other legislation with respect to the manifesting, handling and disposal of biomedical waste.
3. To ensure that waste decontaminating equipment used for the decontamination or destruction of infectious biomedical waste is operated and maintained as prescribed by provincial agencies having jurisdiction.
4. To maintain accurate records of on-site treatment, processing, quantities, and related data in the handling and disposing biomedical waste.
5. To co-operate and comply with requests made by the Laboratory Inspection Service of the Ministry of Health and the Medical Officer of Health with respect to records, procedures and equipment used in the handling and disposing biomedical waste.

3.7 ROLE OF THE HEALTH CARE FACILITY WITH RESPECT
TO BIOMEDICAL WASTE ISSUES

1. To comply with the requirements of the Environmental Protection Act and Regulations with respect to:
 - a) Facility registration and the manifesting of biomedical waste.
 - b) Ensuring that any waste carrier transporting waste to an off-site disposal point is registered with the Ministry of the Environment and is using the Ontario waste manifest form.
 - c) Awareness of hospital (generator) responsibility for the ultimate destruction or disposal of waste.

2. To operate and maintain any on-site incinerator, waste decontamination steam autoclave, and related equipment according to standards and criteria established by the provincial agencies having jurisdiction.
3. To co-operate with the Medical Officer of Health as required in the handling and disposal of biomedical waste to prevent the spread of disease or infection.
4. To provide, where applicable, before the end of March in each year, a report on the preceding year setting out a summary of the source, nature and quantity of waste incinerated in an incinerator owned by the health care facility.
5. To provide, where applicable, a professional assessment of the extent of compliance with Regulation 308 in the operation of that incinerator.
6. To co-operate with, and implement any reasonable biomedical waste handling and disposal recommendation provided by the Canadian Council on Hospital Accreditation resulting from its periodic accreditation assessment of the facility and its operation.

3.8 ROLE OF THE BIOMEDICAL WASTE CARRIER WITH
RESPECT TO BIOMEDICAL WASTE ISSUES

1. To comply with the requirements of the Environmental Protection Act and Regulations with respect to Certificates of Approval, waste manifesting and the proper maintenance of equipment and vehicles.
2. To comply with requirements of the Occupational Health and Safety Act and the Medical Officer of Health with respect to the health and well being of employees and the prevention and spread of disease and infection.
3. To promptly report to the appropriate authorities any accident, incident, spill, and injury that occurs during the handling and transporting of biomedical waste.
4. To clean up any spill of infectious or other biomedical waste or material and promptly decontaminate the area affected in a manner prescribed by the Medical Officer of Health.

5. To deliver biomedical waste only to biomedical waste disposal sites in possession of a Certificate of Approval issued by Ontario or, for sites outside Ontario, the authority having approval jurisdiction over the site outside Ontario.

4.0 MANAGEMENT OF BIOMEDICAL WASTE

4.1 THE DISPOSAL OF BIOMEDICAL WASTE

Biomedical waste disposal had never been regarded as a serious environmental problem in the past mainly because most hospitals and other human health care institutions constructed prior to 1974 traditionally included an incinerator for the on-site disposal of biomedical waste. These wastes in those earlier times consisted mainly of tissue, infectious wet materials, animal bedding and the like. Incinerators of the era were designed to input large amounts of heat to dry off these materials before incineration actually commenced.

Wastes currently generated in modern health care facilities and laboratories have a completely different character and composition. The waste is generally dryer and comprises a very high percentage of plastic material and, in some cases, a high percentage of this plastic material is a halogenated compound such as PVC which, when incinerated, may produce undesirable emissions. In addition to the waste composition in itself becoming highly exothermic, the heat content of the waste on average has risen in some situations to nearly the heat value of the equivalent weight of coal. Under these extreme conditions older designs of incinerators may sometimes release heavy smoke and conceivably infectious particulates into the environment.

In order to accommodate the variation in the composition of modern day biomedical waste, the design of incinerators has evolved from the multi-chambered starved-air design to what is referred to as "controlled air" incineration. By providing a variable controlled air supply and improved combustion controls and by adequate sizing of the primary and secondary burners, any variation of a pre-determined range of heat content in the waste can be accommodated and the waste properly incinerated while conforming to current emission standards.

To ensure that all new hospital incinerators are able to safely incinerate the range of biomedical waste compositions generated currently in compliance with emission standards contained in Regulation 308, the Ministry of the Environment has retained consultants

to review and revise the MOE guidelines on engineering design criteria for biomedical waste incinerators. A report and recommendations on changes to the existing design criteria is expected early in 1986.

4.2 COMPLAINTS OF INCINERATOR ODOUR AND SMOKE

In a 1985 survey of the Ontario Hospital Association of Ontario, 96 hospitals reported that they had on-site incinerators in use and 29 (30%) of these reported that they had difficulties controlling emissions from their incinerators. Ministry of the Environment regional staff from time to time receive complaints of excessive smoke and odour from persons living near some hospitals. These smoke or odour episodes may be caused by factors other than the incinerator design, such as gross overloading of the incinerator above the approved feed rate or the sudden introduction of waste with extremely high heat content (x-ray film, etc.) resulting in an uncontrolled combustion episode.

4.3 SURVEY OF HOSPITAL INCINERATORS

Early in 1985, a number of consulting firms were retained by the Ministry of the Environment to carry out a province wide survey of incinerators. The survey by these consultants and the Ministry covered all regions of the province. Every known working incinerator in human health care facilities, animal care facilities, laboratories, the health related pharmaceutical industry, and crematoria has been identified by the consultants and the Ministry of the Environment.

Since the last survey of incinerators was carried out by the Ministry of the Environment in the early 1970's, only 14 new hospital incinerators have been constructed and almost twice as many other incinerators have been taken out of service.

4.3.1 Hospital Incinerator Inventory

A summary of the Ontario hospital incinerator inventory is presented in Table 1 below:

TABLE 1

MOE REGION	AGE OF HOSPITAL INCINERATOR (YEARS)						TOTALS
	0-5	5-10	10-15	15-20	20-25	25+	
Central	3	5	11	8	4	2	33
West Central	-	-	7	4	5	4	20
Southwest	2	3	17	3	2	1	28
Southeast	-	4	9	6	8	-	27
Northeast	-	3	5	5	2	2	17
Northwest	-	3	5	-	3	1	12
TOTALS	5	18	54	26	24	10	137

Percentage of Total %	3.6	13.1	39.4	19.0	17.5	7.3	100.0
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Because of the drastic change mentioned above in hospital and laboratory waste composition in recent years, any hospital incinerator installed more than 5 years ago probably is not fully capable of meeting current MOE emission standards at the rated feed capacity of the incinerator. Pre-1974 incinerator installations without adequate secondary air and temperature controls will probably not meet current MOE emission standards at any feed rate. This observation may be confirmed over the next year or two when the mandatory annual reports on these hospital incinerators are received and analyzed. (See section 4.6.6.1 of this report re impact of Regulation 309.S.26 on hospitals.)

Table 2 summarizes the probable remedial action required to upgrade hospital incinerators.

TABLE 2

MOE REGION	PROBABLE REMEDIAL ACTION			EXIST INCIN.	PERCENT DEFICIENT
	Replace	Upgrade	Total		
Central	14	2	16	33	48.5
West Central	14	-	14	20	70.0
Southwest	7	9	16	28	57.1
Southeast	8	11	19	27	70.4
Northeast	2	4	6	12	50.0
Northwest	7	7	14	17	82.3
Totals	52	33	85	137	62.0

It should be noted that some or most of the 33 incinerators recommended for upgrading may be of a design that will not permit use of this relatively inexpensive engineering solution. A more detailed engineering analysis would be required to confirm the probable action shown in Table 2.

Using the figures derived above, it is estimated that in order to replace or upgrade these incinerators, the expenditure of at least \$15 million would be required.

4.4 CURRENT COST OF WASTE DISPOSAL FOR HOSPITALS

Some hospitals are not utilizing or fully utilizing installed on-site incinerators, preferring instead to hand over their biomedical waste to commercial haulers who, in turn, transport the waste to incinerators located in the province of Quebec or one of the adjoining States. The two licensed carriers that were most actively soliciting this hospital business in 1985 are known to be charging a variety of handling and removal rates depending on factors such as the length of contract term, the size and location of the hospital in relation to the location of the intended incinerator site. The rate being charged for transportation and destruction is reported to range from \$0.60/kg to as high as \$2.00/kg depending on the degree of competition existing between individual carriers. Actual billings to certain large Toronto health facilities may well exceed \$10,000 each per month for this service.

Hospitals responding to the 1985 survey carried out by the Ontario Hospital Association reported the following average costs for in-house handling of biomedical wastes:

- | | |
|---|---|
| 1. Handling of wastes
(average of 42 responses) | \$280.80/week for an
average size hospital |
| 2. Autoclaving of wastes
(average of 33 responses) | \$197.30/week for an
average size hospital |
| 3. Incineration
(average of 59 responses) | \$444.88/week for an
average size hospital |

An average size hospital (200 beds) handling all its infectious biomedical waste on-site can expect, therefore, to spend about \$4,000 per month on the decontamination of that waste. Additional costs will be incurred in transporting the decontaminated residue to a landfill for final disposal.

4.5 CURRENT COST OF WASTE DISPOSAL FOR PRIVATE LABORATORIES

Private multi-laboratory chains with centralized analytical facilities were seriously affected by the temporary withdrawal of commercial waste carrier service in 1984 during the Markham emergency. To cope with this emergency situation, three or four of the larger operators in the Toronto area installed on-site steam autoclave facilities to decontaminate their waste before disposal to a landfill. These firms opted for steam autoclaves because of their immediate availability and because autoclaves can be installed without having to resort to the onerous public review and approval process required under Part 5 of the Environmental Protection Act as in the case of incinerators.

With less than satisfactory experience in the subsequent use of these autoclaves, some of the private laboratories are reported to have abandoned daily autoclaving in favour of removal of the waste by commercial carriers to incinerators outside Ontario. Some of these laboratories report a scale of waste movement that undoubtedly results in billings to each laboratory in excess of \$10,000 monthly.

Reasons given for discontinuing regular in-house autoclaving of wastes are chiefly economic, such as the cost of close management supervision on a 24-hour basis to ensure that proper decontamination of all the waste is achieved. Other reasons given to justify the use of commercial carriers over autoclaving was the generation of unwanted odour on-site and occupational hazards related to high volume autoclave operation.

4.6 IMPACT OF AMENDMENTS TO REGULATION 309

A significant number of amendments have been made to Regulation 309 that impact directly on generators, carriers and disposers of biomedical waste. These impacts are discussed below:

4.6.1 Legal Definition of Biomedical Waste

Prior to the most recent amendments made to Regulation 309 under the Environmental Protection Act and gazetted on September 28, 1985, biomedical waste was not legally defined. In the 1982 MOE "Guidelines for the Handling, Storage, Collection,

Transportation and Disposal of Pathological and Institutional Wastes" biomedical waste was defined as being pathological waste to conform with the scheme adopted in the Canadian Standard CSA Z317.10-M1981 "Handling of Waste Materials Within Health Care Facilities". This pathological waste definition was subsequently used without substantive change in Regulation 309 to define pathological waste as a sub-category of hazardous waste. This interim action was taken so as not to delay the issuance of the amended Regulation 309 (September 17, 1985) and with the understanding that Regulation 309 would be further amended at a later date to incorporate a broader generic definition of biomedical waste. Approval for the use of the term "biomedical" to replace the term "pathological" was given by the Steering Committee of the interministry Task Force on the Handling and Disposal of Biomedical Waste on July 11, 1985.

4.6.2 Manifesting of Biomedical Waste for Transportation

Generators of "pathological" waste are now required under Regulation 309, as amended, to be registered with the Ministry of the Environment. The use of the Ontario manifest form is mandatory for all transactions originating or completed in Ontario. The federal manifest form may be used for the manifesting of trans-boundary transportation and disposal of this waste. Carriers in Ontario must additionally be in possession of a valid waste management system Certificate of Approval, while any disposal site in Ontario receiving this waste must also be in possession of a valid Certificate of Approval issued for that specific purpose.

The various copies of the manifest pertaining to a particular transaction are subsequently computer matched by the Ministry to ensure that the complete disposal history of any one consignment of biomedical waste can be traced from its point of origin to the final disposal site. It is thus possible to extract from the computer data bank a listing of all registered off-site biomedical waste destruction sites and determine the actual quantities of waste being transported from selected waste generators by selected carriers to approved disposal sites.

4.6.3 Impact on Health Care Industry

The promulgation of these amendments to Regulation 309 has had an immediate and salutary effect on the management of this waste category in Ontario. Hospitals, laboratories and licensed carriers, already highly sensitized by the activities of the Ministry of the Environment and the Task Force on Biomedical Waste and the recent highly publicized investigations and enforcement actions taken against certain carriers and hospitals in the Metro-Toronto area, are responding positively as evidenced by the following:

- Hospitals are increasingly putting into use waste segregation procedures recommended in the MOE guidelines on the handling and disposal of this waste.
- There is a definite swing in hospitals across Ontario to the general use of puncture-proof containers for discarded needles and other sharps.
- There is also an increased use of colour coded plastic bags and rigid containers for the safe handling of this waste.
- Licensed carriers, as part of the manifesting requirements for this waste, may not accept biomedical waste for transportation unless the waste is properly packaged and the hard-shell containers each identified by means of colour coding or symbolic labelling.
- Increasing numbers of carriers are seeking appropriate waste management system Certificates of Approval from the Ministry of the Environment.

4.6.4 Impact on Licensed Waste Carrier

As a result of the increased awareness and public sensitivity, Metro-Toronto municipalities will now not accept at their landfills unpackaged hospital biomedical waste, infectious waste, pathological waste, or waste offensive to the senses. All decontaminated biomedical waste accepted by landfills must be identified as non-hazardous waste and must be properly packaged in opaque black or green plastic bags in appropriate containers. This decontaminated waste should be immediately covered on receipt at the landfill. See Appendix I attached.

One further concern of the industry prior to the promulgation of the amendments to Regulation 309 was the general lack of licensed carriers to handle this waste. Over the past several years only three of five licensed carriers were known to be active in this field, and their activities were generally confined to servicing the greater Metro-Toronto area. A recent survey carried out revealed that other unlicensed carriers were probably engaged in the business of hauling biomedical waste from hospitals located in communities outside Metro-Toronto. With the advent of the amended Regulation 309 many of these hitherto unlicensed carriers have come forward to register and to obtain a waste management system Certificate of Approval issued by the Ministry of the Environment. Carriers that do not comply with the registration and manifesting requirements of the Act and Regulation 309 within a reasonable time span can expect to be prosecuted to the extent of the law.

4.6.5 Impact on the Use of Existing Hospital Incinerators

The fact that all existing hospital incinerators have, under Regulation 309, been made exempt from the operation of Section 27 of the Environmental Protection Act in respect of their establishment, use and operation, has immediately legalized the operation of many hospital incinerators that hospitals previously were operating without a valid Certificate of Approval. The amendment also has the effect of permitting neighbouring hospitals to share available incinerators without resorting to onerous and costly public hearings. To encourage mutual sharing of hospital incinerator facilities and use of their own dedicated biomedical waste transportation vehicles, waste management system Certificates of Approval issued by the Ministry of the Environment to hospitals should not include the full range of conditions and financial guarantees usually imposed on commercial operations licensed as biomedical waste carriers.

4.6.6 Annual Report on Condition of Existing Hospital Incinerators (Regulation 309. S.26)

During the tenure of the interministry Task Force on Biomedical Waste, discussions took place in the Ministry of the Environment and jointly with the Ministries of Health and Labour concerning the mechanism that could be imposed on hospitals to ensure that a systematic program is put in place for the upgrading or replacement of deficient or

defective incinerators. As a result of several recent surveys, it is believed that most of the existing hospital incinerators would, at the very least, have to be mechanically upgraded to meet existing MOE emission criteria. Many incinerators may even have to be replaced.

It was recognized very early in the process that this upgrading program for incinerators could cost many millions of dollars before it was completed. The Ministry of Labour suggested that their procedure of issuing a "Machine Work Order" might be best suited for the purpose of forcing the closing down of selected deficient or defective hospital incinerators on the grounds of potential occupational hazard. Under the Ministry of Labour procedure such an incinerator could only be returned to operation after the specified mechanical upgrading had been completed and approved by that Ministry. In discussions with members of the Task Force Steering Committee it was felt that the Ministry of the Environment should not use this regulatory procedure since deficient or defective incinerators are not being shut down for violations of occupational health standards but rather because the level of emissions from these incinerators are in violation of Regulation 308.

Once the requirements of the Ministry of the Environment with respect to air emissions have been identified, a hospital seeking assistance in funding for incinerator upgrading or replacement should follow the Ministry of Health planning process under the Public Hospitals Act involving plan review and project administration.

4.6.6.1 Annual Submission by Hospital on Operation of Existing Incinerator

Regulation 309.S.26 exempts existing hospital incinerators from Section 27 of the Environmental Protection Act. This exemption is conditional on a submission being made, in respect of the incinerator, before the end of March in each year, of a report on the preceding year's operation setting out a summary of the source, nature and quantity of waste incinerated and a professional assessment of the extent of compliance with Regulation 308.

Appendix II "Instructions on form of annual submission from a hospital operating an on-site incinerator" details the information that must be submitted to the Ministry of the Environment annually.

4.7 SHARING OF WASTE DECONTAMINATION EQUIPMENT IN HOSPITALS

Two scenarios have been examined whereby the existing decontamination facilities in hospitals can be shared by neighbouring waste generators (hospitals and other health care facilities, laboratories, etc.). The scenarios are:

4.7.1 Hospitals Sharing the Use of Existing Incinerators

Recent amendments to Regulation 309 have facilitated this sharing of hospital incinerators by other hospitals. Before Regulation 309 was amended, hospitals wishing to use other incinerators were often not prepared to undertake the formal procedures required to obtain a Certificate of Approval. This requirement has now been waived for hospitals with existing incinerators. It is hoped that the publication of new Ministry guidelines on the use of hospital owned vehicles for the inter-hospital transportation of biomedical waste, using the Ontario manifest form, will encourage more sharing of hospital incinerators.

4.7.2 Existing Incinerators Shared by Other Hospitals and Laboratories

Traditionally, Ontario hospitals have not accepted off-site private laboratory waste for disposal in existing incinerators. Now that Regulation 309 has been amended, hospitals having modern and accessible incinerator plants may accept biomedical waste from other health care facilities and, in certain circumstances, laboratory waste from private sources providing both the waste generator and carrier use the Ontario manifest form for each waste transportation transaction. With some 500 licensed diagnostic laboratories, most privately owned, located across the province, access to suitable existing hospital incinerators would minimize the need for hauling some of this laboratory waste to incinerators outside Ontario.

Only when a hospital incinerator is located on the outside wall of the subject hospital facility or is located in a separate structure away from the hospital and accessible to road vehicles can consideration be given to accepting biomedical waste from another facility. The danger of cross-contamination by the importation of outside biomedical waste precludes access to any hospital incinerator located in the interior of the hospital.

4.7.3 Sharing Existing Steam Autoclave to Decontaminate Waste

The Ministry of the Environment has approved the use of dedicated steam autoclaves for the decontamination of non-anatomical infectious waste. However, with only one or two exceptions, Ontario hospitals are not equipped with sufficiently large autoclaves dedicated solely to the decontamination of non-anatomical infectious waste. Every hospital normally has several steam autoclaves, usually located in or near clean areas for sterilizing equipment/ dressings and for laboratory use. None of these clean area autoclaves should be used for the regular decontamination of infectious waste. A dedicated waste handling autoclave should ideally be located on, or near the loading platform and the boiler plant and should be large enough to decontaminate all the non-anatomical infectious waste delivered daily in a 4-6 hour time span.

Only steam autoclaves dedicated for this special purpose and located on the outside wall of a hospital or located in a separate on-site structure accessible to road vehicles should be shared with other generators of non-anatomical biomedical waste.

The existing policy of the Ministry of the Environment permits such decontaminated waste to be disposed in landfills providing municipal requirements on packaging and delivery of the sterile waste are observed.

4.8 CENTRALIZED WASTE PROCESSING FACILITIES

Centralized biomedical waste processing facilities should be considered as an option before any funds are allocated by the Ministry of Health to individual hospitals for the upgrading or replacement of existing incinerators.

Several hospital groups and private groups are currently in negotiation with various hospitals to provide a centralized disposal facility. Each of the proponents of such a scheme is aware that a public hearing is necessary under the legislation before final approval can be given.

A key recommendation in this report is that the government adopt, as a matter of policy, the concept of encouraging the establishment of centralized biomedical waste disposal facilities where feasible.

4.8.1 Proposed Metro-Toronto Central Incinerator

The concept of a central Metro-Toronto incineration facility for biomedical waste was initially studied in the "Love" report commissioned by the Ministry of Environment in 1973. The plan was to establish a central facility that could service the hospitals in the Metro-Toronto area. No further action was taken to implement this report until the 1984 Markham incident occurred. Metro-Toronto Council then adopted a resolution calling for the establishment of such a centralized biomedical waste incineration facility and a committee was subsequently appointed by Council to locate a suitable site in Toronto for such a central incinerator. No further progress on this project is reported due to the following reasons:

- (1) Metro-Toronto, in the face of competition from private carriers, is not convinced that justification for the major expenditure exists.
- (2) A lengthy and costly public hearing is mandatory for approval of a centralized incinerator facility.
- (3) A large capacity, central incinerator facility would probably have to be equipped with gas scrubbers and heat recovery equipment, both expensive considerations.
- (4) The preferred owners and operators of a central Metro-Toronto facility are the hospitals themselves working through the Hospital Council of Metropolitan Toronto or a private sector operator.
- (5) Finally, Metro-Toronto is reported to have delayed any decision on a central incinerator pending the publication of this strategy report.

4.8.2 Central Incinerator in Other Major Centres

Besides the interest in setting up a central biomedical waste incineration facility in Metro-Toronto, hospitals in other major centres across Ontario are moving in the same direction.

This desire to share common facilities should be encouraged because of economy of scale and because a central authority can provide well-maintained incineration equipment and better control of emissions. Locations suitable for consideration of centralized incineration facilities are communities in which several hospitals are located or (hub) communities that serve a particular area of the province. These communities are:

TABLE 3
TENTATIVE GROUPING OF POPULATION CENTRES
FOR REGIONAL FACILITIES

Metro-Toronto	Sudbury	Kitchener
Cornwall	North Bay	Cambridge
Kingston	Timmins	London
Ottawa	Hamilton	Owen Sound
Perth	St. Catharines	Hanover
Brockville	Welland	Peterborough
Windsor	Niagara	Belleville
Sarnia	Paris	Madoc
Chatham	Brantford	Port Hope
		Dryden
		Thunder Bay
		Sault Ste. Marie

4.9 ENGINEERING PLANNING AND DESIGN CONSIDERATIONS

The 1985 survey of Ontario hospitals carried out by the Ontario Hospital Association revealed that the majority of responding Ontario hospitals were unable to satisfactorily quantify the various waste categories generated in their own institutions. The 1985 study commissioned by the Ministry of the Environment to revise the engineering design criteria for biomedical waste incinerators encountered similar difficulties in trying to gather this type of data on Canadian institutions and had to resort to inconclusive hospital data from several U.S. studies.

The recent 1985 survey of Ontario hospitals indicated that the average size hospital generated an average of 0.75 kg/day for each special care patient.

This value is based on 75 responses from 164 facilities surveyed. In the report prepared by the consultant reviewing the Ministry of the Environment incinerator design criteria, it is noted that Ontario hospital facilities generate between 2.3 kg and 7.7 kg per patient/day. Environment Canada, in a study of the Royal Jubilee Hospital in British Columbia, reports the average waste generation is 2.4 kg/patient/day on an annual basis in that facility.

In a study by Pollock, U.S. West Coast hospitals report that biomedical waste generation over a seven year period ending 1975 increased over 41% for each patient/day to an average value of 7.5 kg/patient/day. Two other researchers, Kremer and Airan, have independently obtained similar biomedical waste generation values in studies of other U.S. hospitals.

4.9.1 Predicting Quantity of Biomedical Waste Generated in a Hospital

For design and planning purposes, the biomedical waste generation potential of any future health care institution should be based on standard values derived from current experience. The Ministry of the Environment, Waste Management Branch, recommends that the following interim standard values be used for design and planning purposes. The values selected compare very well with the experience in other North American hospitals.

4.9.1.1 Predicting Incinerator Capacity

TABLE 4

Interim standard for predicting minimum capacity of incinerator, for planning purposes only.

Hospitals - Total biomedical waste generated
- 6 kg/bed/day
- Special care waste (Infectious, pathological etc) - 1 kg/s.c.bed/day
Laboratories - Non-anatomical infectious waste
- 0.2 kg/patient/day

4.9.2 Sizing of Decontamination Equipment

On-site incinerators being planned for hospitals should, at least, be sized and capable of handling all the potential special care and laboratory biomedical waste generated daily in the facility during a 4-6 hour incinerator operation time span.

Laboratory autoclaves in hospitals should be sized to handle and decontaminate all the non-anatomical waste generated in that laboratory. Biomedical waste from other sources in the hospital should not be brought into such a clean area for decontamination. These wastes should instead be decontaminated in an autoclave specially dedicated to this use and preferably located on the outside wall of the hospital or near the loading dock area. The design-size of such a steam autoclave should be large enough to process, at least, all non-anatomical waste and all the laboratory waste generated daily in the facility or received from off-site sources in a 4-6 hour time span.

4.9.3 Alternate Decontamination Technology

A new technological development that has come to the attention of the task force is a mechanical hammermill/ chemical device that is being tested in the United States for the decontamination of hospital and laboratory waste. Representatives of the Ministry of Health and Environment visited the equipment manufacturer in 1984 and, following a two-year design improvement discourse, have encouraged the manufacturers to develop a device that can safely decontaminate many types of hospital and lab waste without resorting to incineration. This device is claimed to accept all the types of containers, sharps and other materials commonly found in the hospital or laboratory waste stream. In one simultaneous operation, this waste is reduced to grit size by the hammermill and decontaminated by a chemical disinfectant. Use of such a device could conceivably reduce the design size of an incinerator needed to handle a given waste volume by sharing the waste load.

The hammermill device has been approved for use in hospitals in several States by the health and municipal authorities having jurisdiction. In Ontario, its use would require the prior approval from the Ministries of Health and the Environment.

4.10 GUIDELINES ON HANDLING OF BIOMEDICAL WASTE

Each of the provincial Ministries most directly involved in biomedical waste issues have issued guidelines on various aspects of the problem, as follows:

Ministry of the Environment

- Guidelines on the Handling and Disposal of Biomedical Waste, 1986
- Guidelines for Vehicles Transporting Anatomical or Infectious Waste, 1985
- Criteria for Incinerator Design & Operation, 1979.

Ministry of Health

- Laboratory Safety Manual, Laboratory Services Branch.
Guidelines on the Safe Operation of Steam Autoclaves,

The Ministry of Health has co-operated with other agencies in the development of various guidelines such as the handling of infectious patients and cadavers and the disposal of waste from funeral parlours. Information on these guidelines may be obtained from the Public Health Branch of the Ministry of Health.

Ministry of Labour

- Occupational Health & Safety guidelines on the operation, maintenance and repair of biomedical waste incinerators, 1984.

Other Organizations

Several organizations have developed guidelines related to the handling of biomedical waste and some examples follow:

- Medical Research Council of Canada
Guidelines for Handling of Recombinant DNA Molecules and Animal Viruses and Cells, 1980
- Ontario Hospital Association
Guide for the Safe Preparation and Disposal of Antineoplastic Agents, 1982
- Ontario Association of Medical Laboratories
Guidelines for the Handling of Potentially Infectious Biomedical Waste from Medical Laboratories and Specimen Collection Centres, 1985
- Canadian Standards Association
Guidelines on the Handling of Waste Materials Within Health Care Facilities, 1981 (Z317-10).
Currently under revision.

4.11 MANUALS OF PROCEDURE FOR WASTE HANDLING

The accreditation of any hospital is periodically reviewed by the Canadian Council on Hospital Accreditation. As a direct result of input from the task force on the handling and disposal of biomedical waste and representations by the Ontario Hospital Association, the Canadian Council on Hospital Accreditation has agreed to consider including in its routine accreditation review procedures, an assessment of the handling and disposal of biomedical waste procedures in each Ontario facility being reviewed.

To meet the new requirements of the accreditation process, each hospital may have to develop and have on hand detailed manuals of procedure including extensive information on types of hazardous waste, procedures for waste segregation, packaging, storage, colour coding and labelling, and transportation for disposal. Accreditation may further require that hospital staff involved in biomedical waste handling are properly immunized, trained and supervised in carrying out this function.

4.12 LICENSING AND ROUTINE INSPECTION OF LABORATORIES

All hospitals, other human health care facilities and medical laboratories, are licensed by the Ministry of Health and the various facilities are periodically inspected by Ministry staff to ensure that adequate medical standards are maintained.

4.13 TRAINING AND EDUCATION

For any biomedical waste management strategy to be successful, all the workers employed in this area must be made aware of the potential health hazards involved in the handling of biomedical waste and the need to carry out the various handling and disposal activities in a safe manner and in a manner that does not pose risk to the public nor to the environment. This can best be done by the health care facilities and the provincial agencies involved, co-operating in a training and education program designed to meet the needs of specific categories of workers engaged in the handling of biomedical waste.

4.14 RESEARCH NEEDS

Research into improving the efficacy of existing types of equipment is desirable as well and researching new technology. The following areas of research should be explored:

4.14.1 Steam Autoclave

The current technology used to dispose or decontaminate biomedical waste is well known and has been in existence for many decades. The steam autoclave has been routinely used to decontaminate infectious materials in laboratories and in the operating theatre but has never been used on a larger scale to decontaminate waste until quite recently. Where incineration is not permitted in a particular jurisdiction, the only alternate option currently available is steam sterilization in an autoclave.

Regrettably, the steam autoclave cannot efficiently decontaminate all categories of biomedical waste. It is best used to decontaminate non-anatomical infectious waste. Categories of waste not suited for steam autoclaving are bulky materials such as paper and linens, non-porous materials, chemical wastes and anti-neoplastics, solvents and other liquid wastes, radioactive waste, and tissue.

4.14.2 Incinerator

Incinerators have also evolved over the years. In the case of hospital waste where the moisture content and the ratio of plastic materials to other types of waste has changed dramatically over the last decade, older multi-chamber incinerators are not capable of burning modern-day hospital waste to current emission standards.

The modern biomedical waste incinerator is a highly instrumented, controlled air, design capable of burning any composition of hospital waste to current emission standards.

The modern incinerator is capable of destroying most types of hospital waste. The only exception is radioactive waste. However, in burning plastic and chemical waste, temperature control and residence time in the incinerator become the controlling factors influencing the nature of the gas emissions resulting from incineration.

A review of the existing Ministry of the Environment criteria for incinerator design and operation for biomedical waste incinerators, suggests that the incinerator operating temperature and internal gas residence time be elevated. In anticipation of the publication of new design criteria for biomedical waste incinerators, the Ministry of the Environment has notified incinerator manufacturers of the proposed design requirements.

To avoid, as far as possible, the emission of noxious chemical products in the stack gases, some preliminary research into alternate technology for the disposal of biomedical waste has focused on two other promising concepts.

4.14.3 Hammermill

The decontamination of biomedical waste using a combination of mechanical and chemical treatment. A hammermill design is now being tested in the United States. However, the efficacy of the system is yet to be established and approved for use in Ontario.

One advantage this chemical hammermill device has over the autoclave and the incinerator is that it can accept almost any waste material except radioactive and anti-neoplastic waste. It does not produce gas emissions and it may become the preferred method for the disposal of contaminated plastic materials including PVC and other halogenated plastic products.

4.14.4 Radiation for Sterilization of Waste

The second concept, as yet purely experimental, is the exposure of the waste to a high energy radiation source. Several countries are reported to be considering this technology in the processing and sterilization of prepared food products. Irradiation of biomedical waste is, however, not yet proven to be feasible or economic.

4.14.5 Research into Standards on Incineration Emissions and Incinerator Ash

Existing Ministry of the Environment standards for emissions contained in Regulation 308, address some of the chemical constituents of stack gases emitted into the environment. Concern had been expressed by members of the task force that inefficient, uncontrolled, or low temperature burning processes in older incinerators may result in the unplanned release of pathogens to the environment via the stack gasses.

Similarly, inefficient or incomplete burning in the incinerator may result in unacceptable levels of untreated (putrescible) pathogenic matter being contained in the solid residue (ash).

These concerns should be addressed by competent combustion researchers to establish their validity.

5.0 CONTINGENCY PLAN FOR THE EMERGENCY MANAGEMENT OF BIOMEDICAL WASTE

5.1 INTRODUCTION

Past experience has demonstrated that any predictable emergency situation involving biomedical waste is usually local in nature affecting one particular MOE Region and one Health Unit within that MOE Region. On the other hand, because of the delicate balance currently existing in disposing of laboratory wastes, closure of any border, either the US/Canada border or the Quebec/Ontario border or both simultaneously, would immediately result in a situation requiring close provincial management and direction for the disposal of any accumulated biomedical waste. This contingency plan suggests ways for MOE Regions to manage either of two particular scenarios.

5.2 MAJOR EMERGENCY (Affecting more than one MOE Region)

The unplanned closing of either border (US/Ontario or Quebec/Ontario) would immediately cause a back-up in the movement of hospital and laboratory biomedical waste which currently is being disposed in incinerators outside Ontario.

- 5.2.1 If one or other border is closed to the commercial carriers, they can easily adjust to delivering biomedical waste to the other remaining external jurisdiction. Action required of affected MOE Region(s) in this situation should be to monitor the situation closely.
- 5.2.2 If both borders are closed simultaneously, carriers will not be able to pick up or transport biomedical waste for eventual incineration out-of-province. Affected MOE Region(s) in this situation should monitor the situation very closely and review the options available such as using existing incinerator capacity to destroy accumulated biomedical waste. Medical Officers of Health involved and Ministry of Health should be consulted on the situation existing.
- 5.2.3 If necessary, human tissue (pathological waste) can be stored in freezers or re-routed to crematoria in Ontario during such an emergency period.

- 5.2.4 The widespread outbreak of disease in livestock is not considered in this contingency plan. The appropriate authorities may, however, call upon Ministry of the Environment staff for assistance if such an outbreak occurred.

5.3 DISPOSAL OPTIONS DURING EMERGENCY

- 5.3.1 Options open to biomedical waste generators lacking on-site destruction plant, usually private diagnostic laboratories, during such an emergency situation, are:

- i) Arrange to have biomedical wastes incinerated at nearby hospital or autoclaved at competitor laboratory.
- ii) Request MOE, Medical Officer of Health, and municipal approval to permit the landfilling of untreated biomedical waste in separate, secure landfill cells.
- iii) Install on-site portable incinerator on short term emergency basis.

- 5.3.2 Options open to hospitals without on-site incinerators during such an emergency are:

- i) Arrange to have biomedical waste incinerated at a neighbouring hospital having available incinerator capacity.
- ii) Arrange to have anatomical waste stored in frozen condition or cremated or interred.
- iii) Autoclave all laboratory non-anatomical wastes, sharps, etc. and then landfill.
- iv) Arrange to segregate untreated, non-anatomical, biomedical waste in preparation for landfilling in separate, secure cells (subject to MOE, Medical Officer of Health and municipal approval).

- 5.3.3 The disposal of diseased livestock is not considered in this contingency plan and referral should be made to the guidelines published by Agriculture Canada.

5.4 LEAD OFFICIAL/AGENCY

In an emergency resulting from the inability to readily dispose of biomedical wastes, the Ministry of Environment Regional staff shall assume the lead role and shall be supported by the local Medical Officer of Health, the Ministry of Health and other provincial agencies, as required, in dealing with the emergency situation.

In addition, MOE Regional Staff should co-ordinate their efforts, as necessary, with affected municipalities, the MOE Waste Management Branch, the O.P.P., the Ontario Hospital Association and/or the Ontario Association of Medical Laboratories and selected licensed biomedical waste carriers that may be needed to transport the biomedical wastes involved.

6.0 STRATEGY FOR THE MANAGEMENT OF BIOMEDICAL WASTE

The continuing interaction of the Biomedical Waste Task Force and staff of the Ministry of the Environment with other provincial agencies, associations, professional bodies, municipalities, hospitals, laboratories, and the private sector has afforded a better understanding of the many forces and concerns that have influenced the entire biomedical waste handling and disposal issue. The concerns of the public to these same issues is also very well known.

6.1 STRATEGIC CONSIDERATIONS

It is difficult to expect each individual hospital to implement, on its own, the long-term biomedical waste management policy for the province or even for the specific area where the hospital is located. It is imperative, therefore, that a strategy implementation mechanism be put in place by the government to achieve the strategic goal of constant, routine, and environmentally secure biomedical waste management.

A strategy implementation working group could fulfill such an implementation function, and would be charged to implement the provincial strategy by acting as an umbrella committee co-ordinating the strategy implementation activity in each individual region of the province and initiating, in some cases, studies to assess the optimum mix of waste treatment facilities required for the particular area being served.

The working group should work closely with hospitals, commercial laboratories and private entrepreneurs that are already exploring the possibility of constructing regional centres for the disposal of biomedical waste. One such group is the Hospital Council of Metropolitan Toronto, who, with the support of the twenty or so Metro-Toronto hospitals, is exploring the feasibility of such a central facility. Similarly, hospitals in the City of Hamilton are considering construction of one facility to serve the needs of that community.

It is expected that the private sector medical laboratories will become a powerful force supporting this strategy. This industry operates about five hundred licensed laboratories and specimen collection centres across the province. The private laboratories, in many cases, have been refused access to existing hospital incinerators and the bulk of their laboratory waste has had to be transported outside the province for disposal.

6.2 STATUS OF HOSPITAL INCINERATORS

Most hospital incinerators in operation for more than ten years probably do not meet current Ministry of the Environment guidelines because of changed waste composition and resulting incinerator design limitations or because existing incinerators lack the required control instrumentation. In order to provide irrefutable proof of any alleged deficiency, each suspect incinerator may have to undergo rigorous stack emission testing, ash analysis, and investigation of operational constraints and temperatures in each zone in the incinerator. The information gleaned will then determine whether any particular hospital incinerator could be upgraded or whether it should be scrapped and replaced. Since this detailed combustion evaluation could consume ten man days per unit at a cost of about \$5,000 per incinerator, the engineering evaluation should only be required in borderline situations.

6.3 GUIDELINES AND REGULATIONS

6.3.1 Guidelines for the Handling and Disposal of Biomedical Waste

The 1986 revision of the Ministry of the Environment guidelines on the handling and disposal of biomedical waste reflects the changes that have occurred in hospitals and laboratories with respect to the in-house management of this waste and the changes that have occurred in the nature and composition of biomedical waste currently generated in health care facilities and laboratories. The revised 1986 guidelines have been extensively reviewed by the various organizations and agencies represented on the interministry task force on the handling and disposal of biomedical waste. In addition, the Ministries of Health and Labour have reviewed the new draft guidelines for technical accuracy and for conformance with their legislation. The new 1986 guidelines are now available for public information.

6.3.2 Regulation 309

Recent amendments to Regulation 309 and the introduction of the Ontario hazardous waste manifest has increased the awareness level of biomedical waste generators and carriers. In order to consolidate the gains made as a result of the new found interest in the proper handling of biomedical waste, it is proposed that selected sections of the 1986 Ministry of the Environment guidelines be included in a future amendment of Regulation 309. A new definition for biomedical waste is also needed to replace the existing outdated definition of pathological waste. Certain aspects of the waste packaging and transportation requirements given in the guidelines should also be regulated. The amended Regulation will tend to standardize safe management procedures for the handling and disposal of biomedical waste and thereby minimize the risk to the public and the environment.

6.3.3 Regulation 308

When the final report on the revised engineering design criteria for biomedical waste incinerators is issued, it may also be necessary to consider revisions to specific sections of Regulation 308 that are applicable only to biomedical waste incinerators and their operation.

6.4 DESTRUCTION/DECONTAMINATION METHODS

In developing a long term strategy, it is important to be able to weigh the benefits of one or other option for the safe destruction or decontamination of biomedical waste. These options are:

6.4.1 On-site Incineration versus Off-site Treatment

In the years prior to the 1980's almost every hospital was constructed to include an on-site incinerator used to destroy the daily accumulation of biomedical waste generated in that facility. The newer hospitals do not appear to include such incinerators in their mechanical plant plans.

Recent amendments to Regulation 309, under certain conditions, permits the sharing of hospital incinerator facilities by other generators of biomedical waste. An extension of this sharing option is the establishment of a large regional or centralized treatment facility that is capable of receiving and decontaminating biomedical waste from area hospitals and private laboratories. The appropriate approval and public hearing provisions in the legislation would have to be satisfied if this policy option is adopted.

6.4.2 Incinerator versus Autoclave

In January 1985 the task force on biomedical waste invited various leading manufacturers and proponents of specialized equipment used to decontaminate biomedical waste to make technical presentations to the task force on the efficacy of their products. Steam autoclaves were among the products reviewed. (See Section 4.7.3)

Factors in favour of using a steam autoclave were that this equipment could usually be purchased off the shelf. Its use did not require a public hearing or other special Ministry of the Environment approval prior to installation and the decontaminated waste exiting from the autoclave could be disposed in ordinary landfills. Also, hospitals usually had adequate steam capacity available at no extra cost.

Conversely, factors against the wholesale use of steam autoclaves were that, in practice, difficulties existed related to their management, occupational safety, and personnel problems. To assure proper decontamination and treatment, it was necessary to constantly supervise the loading of waste into each bag to ensure uniform density. The operation of the autoclave had to be supervised by responsible staff to ensure that all waste bags were, in fact, passed through the autoclave. Operational criteria limited the autoclave to about 4 cycles/shift. As a result, high volume operations, such as the larger private laboratory chains, generally have to work on a continuous 24 hour basis. Personnel are required to work in an odoriferous (smelly) environment and for safety reasons have to be extremely careful after each cycle is completed to ensure that any liquid material in the autoclave has cooled sufficiently before being removed from the autoclave. All the above factors eventually result in some laboratories holding their autoclaves in reserve, for use only in emergencies.

Finally, because of the inability of the steam autoclave to handle every type of biomedical waste (tissue, radioactives, waste contaminated with antineoplastics, volumes of liquids, etc.) it is necessary that these specific waste categories be sent elsewhere for disposal.

6.4.3 Commercial Disposal Service versus On-Site Facilities

A small number of commercial incinerator operators exist in jurisdictions outside Ontario. These operators are currently accepting biomedical waste generated in Ontario. There are also some hospitals in the Metro-Toronto area that are approved to accept outside biomedical waste for incineration while only one commercial incinerator operator (Tricil, St. Catharines) is licensed in Ontario to accept biomedical waste.

An established network of licensed commercial carriers exists across the province. These carriers are currently transporting biomedical waste from hospitals and laboratories to the existing out-of-province commercial incinerators. Hospitals and laboratories do, however, find this commercial service to be expensive. A cost benefit analysis by one large Toronto hospital in 1985 convinced the hospital to install a modern, automatic function, incinerator to replace the commercial service previously used. Another smaller Ontario hospital has recently analysed its waste handling costs and also has concluded that on-site treatment affords greater cost benefits when compared to the cost of commercial carriers.

Because this commercial carrier/disposal network is efficient, labour saving, and reliable, many hospitals and laboratories will probably wish to continue using their services and not wish to operate on-site plant. In developing a strategy for the disposal of biomedical waste, the private carrier must be accepted as one of the options available to waste generators. However, the commercial services available are in a tenuous state since their disposal facilities are located outside Ontario. The sudden, unplanned closing of the Ontario borders to these carriers is an always present risk.

6.5 RECOMMENDATIONS FOR THE STRATEGIC MANAGEMENT OF BIOMEDICAL WASTE IN ONTARIO

The strategy recommendations in this report have a number of components. These components include short-term solutions such as incinerator upgrading or replacement in selected hospitals, a longer term policy for the establishment of central facilities, publication of new regulations and guidelines which affect waste handling, the use of alternative or new technologies and other options for waste disposal, cost benefit considerations, and research suggestions.

Recommendations 2 through 4 address the immediate needs of Ontario hospitals that depend on their deficient on-site waste incinerators to dispose of their biomedical waste.

Recommendations 1 and 5 through 8 address the longer term strategy for construction of regionally centralized waste disposal facilities. The reliance by hospitals and most medical laboratories for disposal of biomedical waste outside Ontario, combined with the many hospital incinerators requiring upgrading or replacement, leads to the conclusion that a major enhancement of the biomedical waste treatment capacity is essential in Ontario. This increased capacity will lessen the risk to the public health and will materially assist in coping with any foreseeable contingency.

1. Analysis of the hospital incinerator survey data summarized in Tables 1 through 3 suggests that a majority of Ontario hospital incinerators are operationally or mechanically deficient in one or more respects. These incinerators are probably not able to conform to the standards in Regulation 308 mainly because of their age and design. Since this situation is so widespread, it may be opportune at this time to resolve the biomedical waste disposal problem for the future by centralizing these disposal services where feasible. This strategy will permit all biomedical waste generators, the hospitals, medical laboratories and commercial operators, to have access to a central user pay disposal facility offering the following advantages:

- economy of scale through modular design of the centralized facility;

- environmental control through improved control of emissions and use of expert incinerator operators and qualified maintenance staff;
- state-of-the-art equipment resulting in lower emission dispersion levels when compared to many smaller incinerator operations being replaced;
- continuous service ensured through provision of standby plant;
- energy from waste as a potential option;
- only licensed waste carriers using appropriate equipment will have access to the disposal facility.

Accordingly, it is recommended that:

AS A MATTER OF POLICY, THE GOVERNMENT SHOULD PROMOTE THE ESTABLISHMENT OF REGIONALLY CENTRALIZED BIOMEDICAL WASTE DISPOSAL FACILITIES.

In this regard, the potential for using the facilities planned by the Ontario Waste Management Corporation should be explored.

Implementation of this policy option will be influenced considerably by cost/benefit analyses within a region where a number of hospital incinerators require to be upgraded simultaneously. Recommendation 5 addresses the process for selecting the optimum regional configuration.

2. The short-term site-specific needs of hospitals must be recognized and satisfied in the interim as the complementary policy on regional centralization is implemented. It is recommended that:

SHORT-TERM, LOW COST ACTIONS BY HOSPITALS TO UPGRADE DEFICIENT INCINERATORS SHOULD BE RAPIDLY IMPLEMENTED WHEREVER FEASIBLE.

3. A combination of the components of the strategy will lead to the optimum solution for the handling and disposal of biomedical wastes in Ontario, both in site-specific applications and in a broad province-wide sense. To achieve this optimum solution for each area of the province, there is an immediate need to ascertain those hospital incinerators which clearly do not meet provincial regulatory requirements. It is recommended that:

DETAILED COMBUSTION ENGINEERING ANALYSES BE CARRIED OUT ON THOSE HOSPITAL INCINERATORS IDENTIFIED TO BE DEFICIENT.

4. The financial implications of having an incinerator evaluation carried out and having treatment and disposal facilities upgraded is the responsibility of the individual hospital but with assistance provided by the Ministry of Health. Given the apparent backlog of required work (Regulation 309. S.26), it is recommended that:

THE MINISTRY OF HEALTH SET ASIDE A SPECIAL BUDGET TO ASSIST HOSPITALS IN THE UPGRADING OF EXISTING INCINERATORS.

5. The combustion engineering analyses referred to above will clarify what remedial action is needed to meet regulatory requirements and its probable cost. Low cost, remedial action where indicated should be proceeded with as soon as possible. Where replacement of the hospital incinerator is indicated or where the cost of in-situ remedial action is substantial (e.g. exceeds \$100,000), it is recommended that:

BEFORE ANY FUNDS ARE COMMITTED, A COST BENEFIT ANALYSES BE CARRIED OUT OF THE VARIOUS OPTIONS AVAILABLE AND DESCRIBED IN THIS REPORT SUCH AS:

- ON-SITE TREATMENT INCLUDING CONSIDERATION OF NEW TECHNOLOGY OR USE OF PRIVATE CARRIERS;
- CENTRALIZED OR REGIONAL FACILITIES OPERATED BY A HOSPITAL, MUNICIPALITY, PRIVATE SECTOR OR A PROVINCIAL AGENCY.

6. The government should adopt a pro-active stance to encourage hospitals, which are largely autonomous, to move towards centralization of disposal facilities or the sharing of existing facilities. Hospitals should assess their options for waste disposal and consult with the Ministry of Health. It is recommended that:

THE MINISTRY OF HEALTH BE CONSULTED UNDER THE PUBLIC HOSPITALS ACT FOR ASSISTANCE IN FUNDING WITH RESPECT TO LONG TERM IMPLEMENTATION OF THE PROVINCIAL STRATEGY FOR MANAGEMENT OF BIOMEDICAL WASTE.

7. In any planning of centralized biomedical waste disposal facilities the needs of health care facilities and the private medical laboratories located in the area under consideration should be considered. It is recommended that:

MEDICAL LABORATORY BIOMEDICAL WASTE DISPOSAL NEEDS SHOULD BE INCLUDED IN THE PLANNING OF CENTRALIZED BIOMEDICAL WASTE DISPOSAL FACILITIES.

8. In order to assist hospital administrations and the Ministry of Health in selecting and financing incineration or other treatment or disposal alternatives, particularly where centralized facilities are being considered, and in a general sense assist in the implementation of the strategy including initiating area studies, it is recommended that:

A WORKING GROUP OF PROFESSIONALS HAVING REPRESENTATION, AS A MINIMUM, FROM THE MINISTRIES OF HEALTH AND ENVIRONMENT BE APPOINTED AND FUNDED TO ADVISE ON PRIORITIES AND ASSIST IN THE IMPLEMENTATION OF THE STRATEGY FOR THE MANAGEMENT OF BIOMEDICAL WASTE.

This working group will be assisted by broader based regional working groups representing all the organizations having an interest in establishing a regional centralized facility.

9. The provisions of Regulation 309 and other sections of the Environmental Protection Act place stringent controls over the movement and disposal of this hazardous waste. It is recommended that:

ALL GENERATORS OF BIOMEDICAL WASTE REVIEW THE LEGISLATION TO ENSURE THAT THEY MEET THE REQUIREMENTS OF REGULATION 309 INCLUDING REGISTRATION AND MANIFESTING OF THE WASTE, AND THE USE OF APPROVED CARRIERS AND DISPOSAL FACILITIES.

10. The traditional disposal techniques for biomedical waste has been incineration and steam sterilization. Questions have been raised about the adequacy of the air emission criteria for incinerators burning infectious waste. Also, new innovative treatment technology has been developed in the United States which requires demonstration and testing in Ontario. It is recommended that:

RESEARCH INITIATIVES SUCH AS THE TESTING OF ALTERNATIVE TECHNOLOGY AND CRITERIA DEVELOPMENT BE SUPPORTED BY THE MINISTRIES OF HEALTH AND ENVIRONMENT.

11. The policy and guidelines for the disposal and handling of biomedical waste have been revised by the Ministry of the Environment. These guidelines, which contain an updated definition of biomedical waste, have received extensive interministry review. Regulation 309 currently contains an outdated definition of this hazardous waste. Also, the question of including some aspects of the waste handling guidelines into the regulation has been raised. It is recommended that:

THE MINISTRY OF THE ENVIRONMENT REVIEW REGULATION 309 FOR THE PURPOSE OF UPDATING ITS DEFINITION OF "PATHOLOGICAL WASTE" AND CONSIDER THE INCLUSION OF SPECIFIC BIOMEDICAL WASTE HANDLING PROCEDURES INTO THE REGULATION.

12. Waste disposal in an emergency can lead to very undesirable conditions and, in fact, such conditions led to the formation of the Task Force on Biomedical Waste. Every generator and receiver of biomedical waste should have a clear understanding of the contingency procedures required to ensure safe handling and disposal of the waste during emergencies. It is recommended that:

EVERY BIOMEDICAL WASTE GENERATOR AND RECEIVER PREPARE AND HAVE AVAILABLE A CONTINGENCY PLAN FOR THE DISPOSAL OF BIOMEDICAL WASTE IN EMERGENCY SITUATIONS WHEN ROUTINE DISPOSAL ARRANGEMENTS ARE INTERRUPTED. THIS CONTINGENCY PLAN SHOULD BE FILED WITH THE MEDICAL OFFICER OF HEALTH.

REFERENCES

Ontario Occupational Health and Safety Act, RSO 1980.

Ontario Health Protection and Promotion Act, 1983.
- CDC/NIH. 1984 Guideline on Biomedical Waste.

MOE Certificate of Approval. See Environmental Protection Act, RSO 1980. Sections 8, 24, 26, 27, 40 and 136(4).

Ontario Regulation 309, Ontario Gazette, September 28, 1985. General, Waste Management, under the Environmental Protection Act.

Transportation of Dangerous Goods Act (Canada).

Animal Disease and Protection Act (Canada), as amended.

Laboratory Safety Manual, 1982. Laboratory Services Branch, Ontario Ministry of Health.

Canadian Standards Association, Standard CSA Z317.10-M1981, Handling of Waste Materials Within Health Care Facilities.

A Guide for the Safe Preparation and Disposal of Antineoplastic Agents, Ontario Hospital Association, 1982.

Guidelines for the Handling of Recombinant DNA Molecules and Animal Viruses and Cells, 1980. Medical Research Council of Canada.

U.S. EPA Guidelines for Infectious Waste Management, 1985.

Biosafety in Microbiological and Biomedical Laboratories, 1984. U.S. Department of Health and Human Services.

THE MUNICIPALITY OF METROPOLITAN TORONTO

DEPARTMENT OF WORKS
REFUSE DISPOSAL DIVISION

1660.13

October 23, 1985

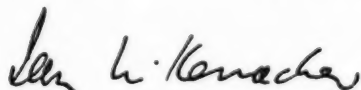
TO ALL HOSPITALS

We have recently experienced a number of instances where bio-medical waste has arrived at our landfill site in Pickering and found to be unacceptable for disposal. In order to clarify our requirements for disposing of hospital waste, we have set out below four rules for hospitals to follow when sending waste to a Metropolitan Toronto Landfill site.

- 1) No pathological waste* shall be accepted.
- 2) All other waste shall be enclosed in double plastic bags of 3 mil thickness. Bags shall be black and opaque.
- 3) Sharps shall be enclosed in hard-shell containers before being placed in the double plastic bags.
- 4) Hospital waste arriving at landfill shall be declared to the weighmaster as coming from a medical establishment and shall be accompanied by a certificate stating that the load does not contain pathological waste.

Our experience has shown that plastic bags and hard-shell containers often break open during the compaction process at hospitals thus exposing our personnel to bio-medical waste which may be hazardous. Should the material arrive at the landfill site in this condition, it will be separated and removed from the site on the assumption that the material is pathological. The cost of removal shall be at the expense of the hospital.

Hospitals which disregard our rules may have their disposal privileges suspended.



I. McKerracher, P. Eng.
Director - Refuse Disposal Division

IMCK/jd

*Pathological Waste as defined in Ontario Regulation 309 (June, 1985) is:

- i. any part of the human body, including tissues and bodily fluids, but excluding fluids, extracted teeth, hair, nail clippings and the like, that are not infectious,
- ii. any part of the carcass of an animal infected with a communicable disease or suspected by a licensed veterinary practitioner to be infected with a communicable disease, or
- iii. non-anatomical waste infected with communicable disease.

APPENDIX II

INSTRUCTIONS ON FORM OF ANNUAL SUBMISSION FROM A HOSPITAL OPERATING AN EXISTING INCINERATOR

ENVIRONMENTAL PROTECTION ACT REGULATION 309 - SECTION 26

- 1.0 Annual Submission on Source, Nature and Quantity
of Waste Incinerated in Hospital Incinerator
- 1.1 The hospital shall keep a daily log of the waste incinerated.
- 1.2 The daily log shall provide details of:
 - the number of hours the incinerator is operated daily;
 - the quantity of waste incinerated daily (kgs/day);
 - the number of batches of waste incinerated;
 - the nature of the waste, Type 4 or other;
 - the source of the waste (from which hospital department);
 - the source of the waste (from outside the hospital).
 - percentage or ratio of PVC plastic to total plastic content of waste incinerated. (Base the estimate on hospital purchasing records.)
- 1.3 Outside waste shall not be accepted by the hospital for incineration unless a licensed carrier delivers the waste and it is accompanied by a properly completed Ontario manifest form.
- 1.4 The hospital shall submit the report for each calendar year before March 31 of the following year.
- 1.5 If a daily log is kept of the waste incinerated, it will be sufficient for the hospital to provide a summary report of the past calendar year activity.

NOTE: For the purpose of these instructions, Type 4 waste refers to hospital waste including pathological waste and infectious waste.

2.0 Professional Assessment of Extent of Compliance with Ministry Requirements and Regulation 308

2.1 Preliminary Evaluation

The professional evaluator shall not proceed with a detailed engineering evaluation until he/she is satisfied that the incinerator is reasonably capable of complying with Ministry of the Environment requirements and with Regulation 308. Factors such as the age and condition of the equipment, the absence of properly located thermocouples, and the absence or inadequacy of control instrumentation, should indicate to the experienced evaluator that a detailed engineering evaluation may be a waste of time and money. Under these circumstances, the incinerator owner should be advised not to proceed with the assessment and the Ministry of the Environment should be advised that the subject incinerator does not comply with the Ministry requirements nor with Regulation 308.

2.2 Technical Assessment of Hospital Incinerator

The assessment in respect of compliance with the Ministry requirements and Regulation 308 should be carried out by a qualified professional having the appropriate background and experience in combustion engineering practice. The Ministry of the Environment reserves the right to reject any assessment for cause, including lack of technical competence.

2.3 The Assessor Shall Provide a Signed and Dated Report That Includes:

- the name and address of the incinerator owner;
- a description of the incinerator and date of installation and, if available, the Certificate of Approval number;
- percentage or ratio of PVC plastic to total plastic content of waste incinerated. (Base the estimate on hospital purchasing records.);
- dispersion calculations to determine contaminant concentrations at critical receptors should be provided for the following parameters:

- particulate
- NOx
- a dispersion calculation based on an emission rate of 1 g/s. (This value will be prorated by the Ministry of the Environment to determine point of impingement concentrations for other pollutants of concern.)

In addition, the following information should be provided:

- flue gas flow rate (m^3/h)
- all pertinent data used in the dispersion calculations (eg. building dimensions, stack height, emission rates, distance to critical receptor, etc.)
- visual observation of the stack exhaust;
- total hydrocarbon;

Total hydrocarbon levels in the stack flue gases should be determined by measurement (measurements may be made in breeching or in stack);

- a report on any deficiencies (mechanical, design and operating) found in the existing incinerator including a comparison with the current Ministry of the Environment incinerator design and operating criteria for Type 4 waste incinerator;
- specific and detailed recommendations for upgrading of the incinerator to comply fully with Ministry requirements and Regulation 308;
- a heat and material balance calculation;
- if applicable, an application from the hospital to the Ministry of the Environment and supporting documentation necessary for the hospital to obtain written concurrence that the incinerator conforms to Regulation 308 and the current incinerator design and operating criteria for Type 4 waste incinerator.

2.4 Evaluation in Subsequent Years

Any incinerator assessment accepted by the Ministry of the Environment pursuant to Regulation 309 S.26 will remain in force unless changes or modifications are made to the incinerator or its components. Any future proposed changes or modifications to the incinerator and in its operation or changes in the composition of waste incinerated will require that the owner obtain a new Certificate of Approval issued by the Ministry before the change or modification is made to the incinerator or its operation.

Ministry of the Environment
Waste Management Branch